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SOP No. ISSI-VBI70-06

Title: GARDEN VEGETABLE SAMPLING AT RESIDENCES FOR DETERMINATION OF RISK-BASED EXPOSURE TO METALS

APPROVALS:

Author ISSI Consulting Group, Inc. Date: September 10, 1999

SYNOPSIS: A standard method for exposure-based residential garden vegetable and soil sampling is described. Protocols for sample collection and handling are provided.

Received by QA Unit:

REVIEWS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
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1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide a standardized method for residential garden vegetable and soil sampling, to be used by employees of USEPA Region 8, or contractors and subcontractors supporting USEPA Region 8 projects and tasks. This SOP describes the equipment and operations used for sampling residential garden vegetables and soils in areas which will produce data that can be used to support risk evaluations. Deviations from the procedures outlined in this document must be approved by the USEPA Region 8 Remedial Project Manager or Regional Toxicologist prior to initiation of the sampling activity.

2.0 RESPONSIBILITIES

The Field Project Leader (FPL) may be an USEPA employee or contractor who is responsible for overseeing the residential garden sampling activities. The FPL is also responsible for checking all work performed and verifying that the work satisfies the specific tasks outlined by this SOP and the Project Plan. It is the responsibility of the FPL to communicate with the Field Personnel regarding specific collection objectives and anticipated situations that require any deviation from the Project Plan. It is also the responsibility of the FPL to communicate the need for any deviations from the Project Plan with the appropriate USEPA Region 8 personnel (Remedial Project Manager or Regional Toxicologist).

Field personnel performing residential garden vegetable and soil sampling are responsible for adhering to the applicable tasks outlined in this procedure while collecting samples. The field personnel should have limited discretion with regard to collection procedures, but should exercise judgment regarding the exact location of the Sample Point, within the boundaries outlined by the FPL.

3.0 EQUIPMENT

- Soil augers - Various models of soil augers are acceptable and selection of the specific brand and make of tool is at the discretion of the contractor implementing the field work. Augers are usually made of stainless steel, and should be capable of retrieving a cylindrical plug of soil 2 inches in diameter and 6 inches in depth. In all cases, the procedures recommended by the manufacturer should be followed with regard to use of the auger. Augers with disposable plastic sleeves may be employed to minimize the decontamination effort.

- Collection containers - plastic ziplock bags (gallon-size capacity).

- Shovel - for collecting root vegetables. Must be lead free and unpainted.

- Trowel - for extruding the soil from the auger; for digging up plants. May be plastic or stainless steel.

- Gloves - for personal protection and to prevent cross-contamination of samples. May be plastic or latex. Disposable, powderless.

- Squeeze Bottle - for dispensing deionized water. Used to clean and decontaminate sampling equipment. Must be labeled "DI Water".

- Squeeze bottle -for dispensing potable (drinking) quality water. Used to clean and decontaminate sampling equipment. Must be labeled "TapWater".

- Deionized Water - for rinsing vegetable samples.

- Plastic Buckets - used to rinse vegetables, and to receive rinse water generated in the course of tool cleaning.

- Vegetable Brush - used to scrub soil from root vegetables.

- Wipes - disposable, paper or baby wipes. Used to clean and decontaminate sampling equipment.

- Clippers - for cutting samples from plants.

- Laboratory Surfactant - used to decontaminate sampling equipment. Alconox is a brand in common use.

- Field clothing and Personal Protective Equipment - as specified in the Health and Safety Plan.

- Field notebook - a bound book used to record progress of sampling effort and record any problems and field observations during sampling.

- Three-ring binder book- to store necessary forms used to record and track samples collected at the site. Binders will contain the Garden Vegetable and Soil Data Sheet, Site Diagram, and sample labels. Example forms are provided in Attachment 1.

- Permanent marking pen - used as needed during sampling and for documentation of field logbooks and data sheets.

- Measuring tape or wheel - used to measure each garden.

- Measuring tape or pocket ruler - used to measure the length of soil core in the soil

coring device.

- Trash Bag - used to dispose of gloves and wipes.

4.0 SAMPLING PATTERN

At each garden selected for sampling, one sample of each type of vegetable and one companion sample of garden soil will be collected as detailed below.

4.1 Sample labeling and Field Data Sheet

Using a measuring wheel or measuring tape, measure the dimensions of the garden. If there are no clear boundaries of the garden, measure to about six inches from the end of each row or cluster of plants.

Prepare a diagram of the garden using the Garden Vegetable and Soil Data Sheet (Attachment 1). Indicate the location of different types of crops within the garden, as well as any anomalies in soil color, soil texture, or any noticeable differences among the plants (i.e., one side or patch of the garden is dead). As a time saving mechanism, a coding system may be used on the site diagram (c = corn, t = tomato, etc.), but the coding definition **must be indicated** in the plant type section of the form (see Attachment 1). Abbreviations must be standardized across sampling teams. Therefore, if a field team encounters a vegetable for which there is no established code, the team should immediately call the FPL for a recommendation. Record the locations of vegetable and soil samples collected from the garden, using a circled 'v' for vegetable samples and a circled 's' for soil samples. Follow the collection procedures as detailed below.

5.0 COLLECTION OF LEAFY VEGETABLES

Leafy-type vegetables include crops such as lettuce, cabbage, beet greens, turnip greens, spinach, rhubarb, parsley, and cilantro. Each new vegetable is considered a new sample. A clean pair of gloves should be worn at all times and changed before each different sample is collected. Select one or more plants to collect for the sample, and mark the location of those plants on the site diagram. The minimum amount that must be collected is 200 g (wet weight). Sample weight can be determined by the use of a balance, or it can be estimated using an object that is known to be approximately 200g, and comparing the sample weight to the weight of that object. It is not necessary to weigh the sample to precisely 100g.

Harvest the plant as it would be in a commercial garden. In the case of lettuce, cut the entire

plant at ground level. In the case of beet greens, if the root is not to be analyzed, the leaves may be cut from the plant leaving the beet root in the ground. Using a clean plastic bucket that has been partially filled with deionized water, immerse the sampled plant material in deionized water and wash the dust and soil from the plant using gentle agitation for one minute. Drain the water from the plant and place the entire sample in a plastic ziplock bag that has been properly labeled. Place the sample immediately in a secured cooler at a temperature of 4° C. If the sample is too large to fit securely in the bag, remove a small portion, and dispose of the excess material according to SOP #MK-VBI70-04. Do not force the sample into the bag, as this may result in the bag opening during transport.

Follow the decontamination procedure described in Section 10.0 to decontaminate any equipment that was used. Remove gloves and place in the trash bag for disposal.

6.0 COLLECTION OF ROOT VEGETABLES

Root-type vegetables include crops such as radishes, turnips, carrots, potatoes, beets, parsnips, rutabegas, kohlrabi, jerusalem artichoke, onion, sweetpotatoes, and leeks. A clean pair of gloves should be worn at all times and changed before each sample is collected. Harvest the plant as it would be in a commercial garden. Select one or more plants to collect for the sample, and mark the location of those plants on the diagram. The minimum amount that must be collected is 200 g (wet weight). Sample weight can be determined by the use of a balance, or it can be estimated using an object that is known to be approximately 200g, and comparing the sample weight to the weight of that object. It is not necessary to weigh the sample to precisely 200g.

Using the shovel, dig a circle around the base of the plant, then dig up the entire plant, gently removing it from the soil. Bring up the entire shovel-full of earth and plant material, and shake the plant free from the earth mass. Shake off as much soil from the root as possible, then use the clippers to cut off the top of the plant. Do not cut the top of the root portion of the plant. If the top of the plant is being sampled (beet greens, turnip greens, etc.), follow the procedures in Section 5.0 and prepare this portion of the sample before preparing the root portion. The green tops of the plant should be removed before washing.

Roots should be washed by repeatedly immersing them in a bucket of deionized water and scrubbing the taproot surface with a brush. Change the water in the bucket if it becomes muddy. The roots should have no visible soil adhering to the surface. After scrubbing, roots should be given a final rinse in a bucket of deionized water, placed in a labeled plastic bag, and stored in a secure cooler at 4° C.

Garden soil excavated as part of root vegetable sampling should be replaced and the surface lightly tamped down. Vegetable material not to be analyzed but generated as part of the sampling effort (carrot greens for example) should be disposed according to SOP #MK-VBI70-04.

Follow the decontamination procedure described in Section 10.0 to decontaminate any equipment that was used. Remove gloves and place in the trash bag for disposal.

7.0 COLLECTION OF GARDEN FRUITS

Fruit-type vegetables include crops such as peppers, tomatoes, zucchini, yellow squash, summer squash, okra, cucumbers, broccoli, cauliflower, eggplant, snowpeas, yellow wax beans, green beans, corn, celery, asparagus, brussels sprouts, and artichokes. A clean pair of gloves should be worn at all times and changed before each sample is collected. Harvest the plant as it would be in a commercial garden. Select one or more plants to collect for the sample, and mark the location of those plants on the site diagram. The minimum amount that must be collected is 200 g (wet weight). Sample weight can be determined by the use of a balance, or it can be estimated using an object that is known to be approximately 200g, and comparing the sample weight to the weight of that object. It is not necessary to weigh the sample to precisely 200g.

In the case of tomatoes, the fruit may be pulled directly from the vine using a gloved hand. It may be necessary to use decontaminated clippers to cut the tomato fruit from the plant. Rinse the tomatoes by immersing them in a bucket partially filled with deionized water and wipe them while under water to remove any visible soil. Place the fruits in a new appropriately labeled ziplock bag and store in a cooler at 4° C.

In the case of corn, samples should be prepared by removing the edible portion, and placing it directly inside the sample container. Begin by removing the corn husk from the ear, and then immerse the ear in a clean plastic bucket partially filled with deionized water. Gently agitate for one minute. Shake off the excess water, and cut the kernels from the cob, using a clean knife. Hold the ear so that the corn kernels fall directly into the sample container. Husks, the cleaned cob, and kernels that fell outside of the bag should be disposed according to SOP #MK-VBI70-04.

Follow the decontamination procedure described in Section 10.0 to decontaminate any equipment that was used. Remove gloves and place in the trash bag for disposal.

8.0 COLLECTION OF GARDEN SOIL

The surficial (0-6 inch) sampling locations identified within a garden will be based on the collection of vegetable samples. At each vegetable sample location, a corresponding soil

(grab) sample will be collected. Grab samples should be collected next to the plant being sampled, at a maximum of 6 inches from the plant.

Before collecting samples, the location must be recorded on the Garden Vegetable and Soil Data Sheet. Grab sample location should be marked with a circled 's' on the site diagram (Attachment 1). Use a new pair of gloves for each sample. Place the soil coring tool on the ground and position it vertically. Holding the tool handle with both hands, apply pressure sufficient to drive the tool approximately six inches into the ground while applying a slight twisting force to the coring tool. Remove the tool by pulling up on the handle while simultaneously applying a twisting force. If the sample was retrieved successfully, a plug of soil approximately six inches long should have been removed with the coring tool.

Hold the soil coring tool horizontally or place it on the ground. Using a clean spatula or knife, remove the soil collected at depth greater than six inches from the end of the sampling tool. Allow this soil to fall back into the garden. Use a trowel to extrude the soil from the auger, pushing the six-inch soil plug from the coring tool so that it falls directly into the sample container. Repeat the steps outlined above for each grab sample that is collected.

Garden soil sample preparation will be performed in accord with the Sample Preparation SOP (#MK-VBI70-05).

If sampling equipment is to be re-used, follow the decon procedures outlined in Section 10.0 before collecting the next sample.

9.0 RECORD KEEPING AND QUALITY CONTROL

Each field crew will carry a three-ring binder book that contains the Garden Vegetable and Soil Data Sheet, and sample labels. In addition, a field notebook should be maintained by each individual or team that is collecting samples, as described in the Project Plan. At the end of each day, the field crews will submit the site sketches and data sheets to the FPL. Each sampled garden must have site sketches with vegetable sample locations, soil sample locations, and sample ID labels, as described in SOP #ISSI-VBI70-01. Deviations from this sampling plan should be noted in the field notebook, as necessary.

For each property, the notebook information must include:

a. date
b. time
c. personnel
d. weather conditions
e. sample identification numbers that were used
f. locations of any samples that could not be collected, and the reason for the deviation

g. descriptions of any deviations to the Residential Garden Vegetable Sampling Plan and the reason for the deviation

Samples taken from soils with visible staining or other indications of non-homogeneous conditions should also be noted.

As specified in the Sampling Plan, at various points in the sampling effort field personnel should expect to collect quality control samples. These may include filling two sample containers with soils that have been taken from the same garden. It may also include filling two sample containers with the same type of vegetable.

10.0 DECONTAMINATION

After each type of sample is collected, and at the end of each day's sample collection work, all tools must have visible soil removed, be washed with drinking water and laboratory surfactant (Alconox), and triple rinsed with deionized water, as described in SOP #MK-VBI70-07. Wipes, gloves, rinse solutions, and excess plant material must be disposed or stored properly as specified in SOP #MK-VBI70-04.

11.0 SAMPLE TRANSPORT

After collecting all of the samples, check to make sure that each sample label ID number matches the ID number on the Data Sheet. Samples must be transported to the laboratory at the end of each day, on wet ice (4°C). Samples should be packed so as to minimize degradation of plant material (e.g., soil samples should be not be packed on top of leafy samples). Chain-of-custody (COC) forms must be included in each cooler. Forms should be sealed inside a plastic bag to protect against possible water damage during transport. COC procedures are described in the SOP #MK-VBI70-02.

ATTACHMENT 1

ATTACHMENT 1

GARDEN VEGETABLE AND SOIL DATA SHEET - page 1

PHASE: 3 **DATE:** _____

SAMPLE COLLECTION METHOD: ISSI-VBI70-06 Revision 0 **TIME:** _____

SAMPLE TEAM ID: _____ **MEDIA:** GS (Garden Soil)

ADDRESS: _____ V (Vegetable)

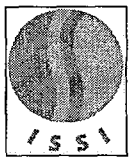
House#

_____

Street Name

SAMPLE TYPE: (circle one)	original sample ID #	VEGETABLE SAMPLE ID LABEL
FS FD		3-#####-R
FS FD		3-#####-R
FS FD		3-#####-R
FS FD		3-#####-R
FS FD		3-#####-R
FS FD		3-#####-R
FS FD		3-#####-R

ATTACHMENT 1
GARDEN VEGETABLE AND SOIL DATA SHEET - page 2



PHASE: 3 **DATE:** _____

SAMPLE COLLECTION METHOD: ISSI-VBI70-06 Revision 0 **TIME:** _____

SAMPLE TEAM ID: _____

MEDIA: GS (Garden Soil)

ADDRESS: _____
House#

V (Vegetable)

_____
Street Name

SAMPLE TYPE: (circle one)		original sample ID #	SOIL SAMPLE ID LABEL	
FS	FD		3-#####-R	GRAB
FS	FD		3-#####-R	GRAB
FS	FD		3-#####-R	GRAB
FS	FD		3-#####-R	GRAB
FS	FD		3-#####-R	GRAB
FS	FD		3-#####-R	GRAB
FS	FD		3-#####-R	GRAB

ATTACHMENT 1
GARDEN VEGETABLE AND SOIL DATA SHEET - page 3

SITE DIAGRAM

VEGETABLE TYPE (S)

CORN (C)	BEANS (BN)
TOMATOES (T)	LETTUCE (L)
SQUASH (SQ)	PEPPER (P)
BEETS (BT)	

(S) = soil sub-sample
(V) = vegetable sample

Samples Collected By: _____ Date: _____

Logbook Page reviewed By: _____ Date: _____

ATTACHMENT 2

Logbook DCN _____

ATTACHMENT 2

EXAMPLE GARDEN VEGETABLE AND SOIL DATA SHEET - page 1

PHASE: 3

SAMPLE COLLECTION METHOD: ISSI-VBI70-06 Revision 0

DATE: _____

SAMPLE TEAM ID: _____

ADDRESS: _____ **TIME:** _____

House#

_____

Street Name

MEDIA: GS (Garden Soil)

V (Vegetable)

SAMPLE TYPE: (circle one)	**original sample ID #**	**VEGETABLE SAMPLE ID LABEL**
FS FD		3-#####-R
FS FD		3-#####-R
FS FD		3-#####-R
FS FD		3-#####-R
FS FD		3-#####-R
FS FD		3-#####-R
FS FD		3-#####-R

Logbook DCN_____

ATTACHMENT 2
EXAMPLE GARDEN VEGETABLE AND SOIL DATA SHEET - page 2

PHASE: 3 **DATE:** _____

SAMPLE COLLECTION METHOD: ISSI-VBI70-06 Revision 0 **TIME:** _____

SAMPLE TEAM ID: _____

MEDIA: GS (Garden Soil)

ADDRESS: _____
House#

V (Vegetable)

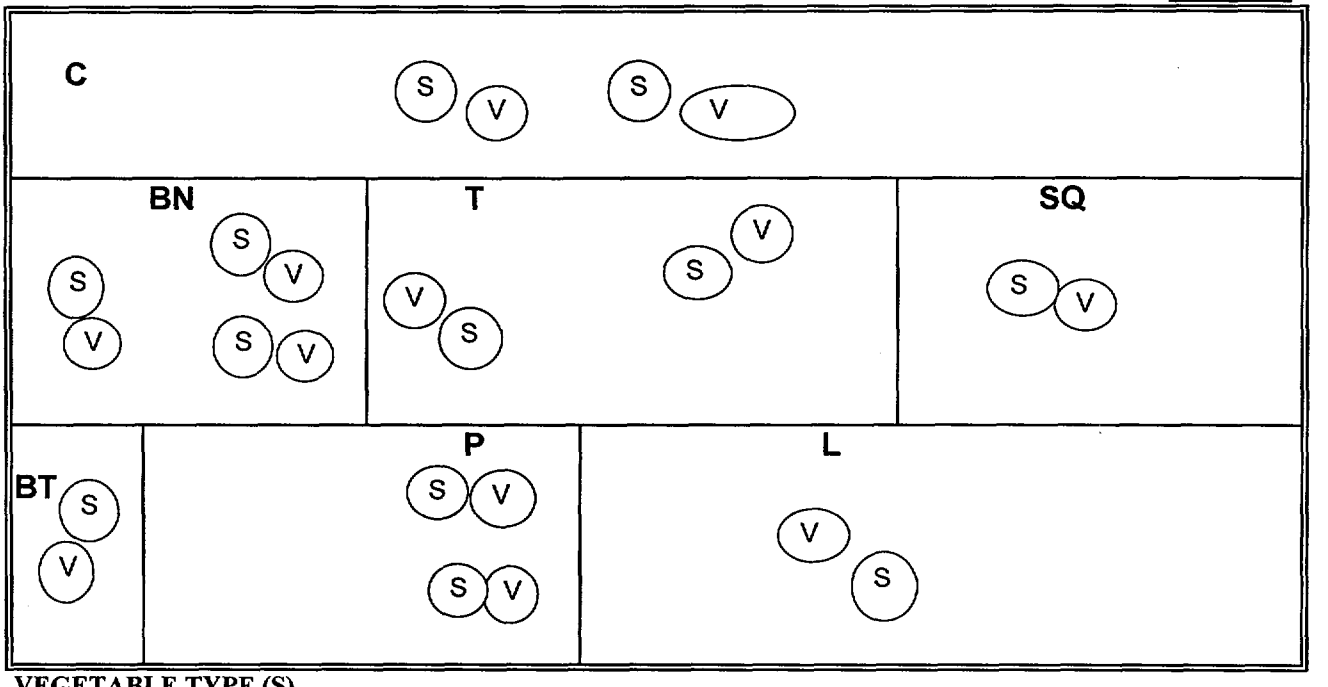
_____
Street Name

SAMPLE TYPE: (circle one)	original sample ID #	SOIL SAMPLE ID LABEL	
FS FD		3-#####-R	GRAB
FS FD		3-#####-R	GRAB
FS FD		3-#####-R	GRAB
FS FD		3-#####-R	GRAB
FS FD		3-#####-R	GRAB
FS FD		3-#####-R	GRAB
FS FD		3-#####-R	GRAB

Logbook DCN_____

ATTACHMENT 2
EXAMPLE GARDEN VEGETABLE AND SOIL DATA SHEET - page 3

SITE DIAGRAM



VEGETABLE TYPE (S)

CORN (C) _____

BEANS (BN) _____

TOMATOES (T) _____

LETTUCE (L) _____

SQUASH (SQ) _____

PEPPER (P) _____

BEETS (BT) _____

_____ _____

_____ _____

(S) = soil sub-sample

(V) = vegetable sample

Samples Collected By: _____ Date: _____

Logbook Page reviewed By: _____ Date: _____